Whale tracking is all up in the air

Tracking the underwater wanderings of whales can be a tricky business. Not only must scientists try to shadow a cetacean for weeks at a time, but while doing so, expedition members also must risk losing the whale and turning the tracking process into an oceanic game of hide-and-seek.

Now one researcher has found a way to keep close tabs on a pilot whale without ever leaving his office. Bruce R. Mate of Oregon State University's Hatfield Marine Science Center in Newport has tapped the resources of satellite tracking in order to follow the forays of a whale found beached on Cape Cod, Mass., in June. To date, the satellite has relayed information about the whale's diving habits for about seven weeks, habits that are monitored 24 hours a day by a small transmitter neatly attached to the whale's dorsal fin.

"This far exceeds any amount of information we've gotten from a whale before," Mate told SCIENCE NEWS. "We're learning what they're capable of for the very first time."

Mate is continuing his weekly compilation of preliminary results and plans to present his findings in September at the International Argos Users Conference in Washington, D.C. Although he used a satellite to track a humpback whale for six days in 1983, this is the first time one has been used for tracking an ocean mammal long-term, he says. In those four years, technology has downsized the transmitter by half and increased its longevity some four times. Mate is working with John Prescott of the New England Aquarium in Boston and Joe Geraci of the University of Guelph in Ontario.

Whale researchers haven't used satellite tracking in the past, he says, because until recently, there wasn't a transmitter small enough to monitor a whale's diving habits by satellite without restricting its movement. The transmitter is specially designed to withstand deep-sea pressures and is operated by organic lithium batteries, which provide more power per unit size than any other commercially available battery, says Mate. About the size of a large coffee cup, the device contains a microprocessor that essentially keeps track of a quartz clock during the dives. As the whale descends after a dive, the device begins keeping track of the time, and then, when the whale surfaces, it checks the clock and computes how long the dive was. In addition, Mate says, it checks the temperature, adds the latest dive to those monitored in the past 12 hours and computes an average time of duration for those dives.

Mate's relay for all of this information is a National Oceanic and Atmospheric Administration satellite, which is principally used for gathering and sending weather data. Mate receives information from the satellite some 12 times a day, and by analyzing the Doppler shift recorded by the satellite as it passes over the whale, he can deduce the whale's location within about 500 meters most of the time. At press time, the whale was about 110 miles east of Boston, and when last sighted in July it was traveling with about 100 other whales.

What Mate's seen so far has been revealing. "I guess the consistency of the animal is something that really amazes me," he says of the whale that does a couple thousand dives a day. "I'm impressed at how much they move. Within the first two weeks they moved over 600 miles." For an animal that is about 11 feet long and weighs about 1,000 pounds, "that's a pretty energetic critter." In addition, Mate says, the dive patterns change when the whale finds food, squid being its main fare.

In conventional tracking, Mate says, constant shipboard surveillance is required and researchers estimate the duration of dives by noting the time between the beeps recorded on ship that indicate the whale's ascent. Satellite tracking, on the other hand, provides a more precise measurement of how long each dive is. The satellite also can follow its target to hard-to-reach places, such as the northern Arctic during the months without sun. And with satellite tracking, Mate says, researchers don't run into the problem of a nearby ship possibly altering the whale's natural course. One of the only disadvantages, he says, is that the transmitter being used for this satellite is a little larger than those used in conventional tracking, and could cause some hydrodynamic drag for the whale.

Mate/Oregon State University

This satellite transmitter, shown on a humpback whale, contains the same electronics as the one attached to the pilot whale being tracked.

Mate hopes to track the animal for a total of two and a half to three months. The best thing about the transmission technique, he says, is that it eliminates the expense of hiring a crew of scientists and chartering a vessel to monitor a whale. He figures that by now a chartered boat alone would have cost him $150,000. The biggest expense with satellite tracking is the transmitter, he says, which costs $3,000 to $5,000. Receiving transmissions, on the other hand, costs only about $3 per day — cheaper, Mate says, than taking a graduate student to lunch. — *K. Hartley*

Keeping dioxins down in the dumps

When the contents of a household trash can — an unsavory melange that may include chicken bones and food scraps, empty cans and bottles, plastics and foils, worn clothing and rags, and lots of paper products carrying a wide range of inks and coatings — burn up in a municipal incinerator, the process creates hundreds of compounds, which get trapped in fly ash or escape into the air. This noxious mixture spewed out by incinerators includes about 200 compounds known as polychlorinated dibenzodioxins and polychlorinated dibenzofurans, many of which are toxic and some of which are potentially cancer-causing.

For the last decade, researchers throughout the world have been studying how dioxins and furans are generated and how to reduce the levels of these compounds in emissions from municipal incinerators. Because incineration is a major contributor of dioxins to the environment, fears of contamination have slowed the building of incinerators to solve urban garbage problems.

Two recent reports, however, show that incinerators can be operated under conditions that minimize dioxin and furan emissions and provide clues about the conditions under which dioxins form.

One study, conducted at an incinerator facility in Pittsfield, Mass., concerned the role of combustion in generating and destroying dioxins and furans. The research was initiated by the New York State Energy Research and Development Authority (NYSERDA) in Albany and supervised by members of the Dioxins Committee of the American Society of Mechanical Engineers (ASME), based in New York City.

The researchers looked at how a wide range of combustion conditions and refuse quality affected the amount of dioxins and furans formed and destroyed during combustion. They found that neither the amount of polyvinyl chloride (PVC) plastic found in trash nor the wetness of the garbage is related to the level of dioxins or furans produced under good combustion conditions. Some scientists had suspected PVC in trash as a major contributor to the formation of dioxins.

The level of carbon monoxide and the incinerator operating temperature, however, were found to be related to dioxin levels. According to the study, by monitoring carbon monoxide amounts or